Hail Damage Test Process Design USAF

Project

Wing dimpling due to hail damage can result in costly aircraft reskin efforts

Objective: Determine the aerodynamic effects of hail damage on a NACA 0012 wing section

- Angle where the aircraft stalls
- The maximum lift of the aircraft
- The drag on the aircraft due to dimpling

Simulation Process

Process

Testing Process

- Damage levels: Undamaged, ground, inflight
- Flight conditions: Take-off/landing, cruising
- Five models tested
- Iterate the angle of attack
- Statistical post-processing

Results

Ground damaged wing section

Undamaged gradual separation vs damaged sudden separation

Flight Condition | Damage Condition | Angle of Separation | Max Lift Coeff. | Drag Coeff. at 0° AoA
--- | --- | --- | --- | ---
Take-off/landing | Undamaged (baseline) | 17° | 1.632 | 0.00742
Ground | 11.529° (-38%) | 1.188 (-32%) | 0.00784 (+6%)
Inflight | 12.734° (-29%) | 1.365 (-18%) | 0.0074 (+0.34%)
Cruising | Undamaged (baseline) | 7.562° | 0.865 | 0.00841
Ground | 6.6° (-14%) | 0.771 (-12%) | 0.00877 (+4%)
Inflight | 6.925° (-9%) | 0.815 (-6%) | 0.00865 (+3%)

Conclusion

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